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Weather analyses and forecasts of the Southern Ocean and Antarctica, where conventional atmospheric observations such as surface stations and radiosondes are sparse, are enhanced by assimilating Global Positioning System – Radio Occultation (GPS-RO) soundings. GPS-RO measurements are extremely accurate in all-weather conditions. This unbiased reference data set has been shown to provide more accurate large-scale circulation and the development of cyclones along the coast of Adélie Land, a process that some global models struggle to resolve. We present results of simulations using the polar version of the Weather Research and Forecasting (Polar WRF) model along with the WRF Data Assimilation (WRFDA) system. Sensitivity simulations provided an optimal Polar WRF configuration and updated algorithms for the assimilation of Constellation Observing System for Meteorology Ionosphere and Climate (COSMIC) and other GPS-RO profiles into WRFDA. Two year-long simulations (June 2008 – May 2009) at 15 km horizontal resolution were conducted over Antarctica and the Southern Ocean, one with and one without GPS-RO included in the assimilation. Results show surface variables compare well to observations and reanalyses. Complex terrain and steep topographic relief in Antarctica presents a major challenge to improving surface pressure. However, with GPS-RO assimilated, surface pressure notably improves over the high interior of Antarctica. This impacts the representation of baroclinicity across the entire Adélie Land region, leading to the additional accuracy in cyclone position and development throughout the South Pacific Ocean.
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